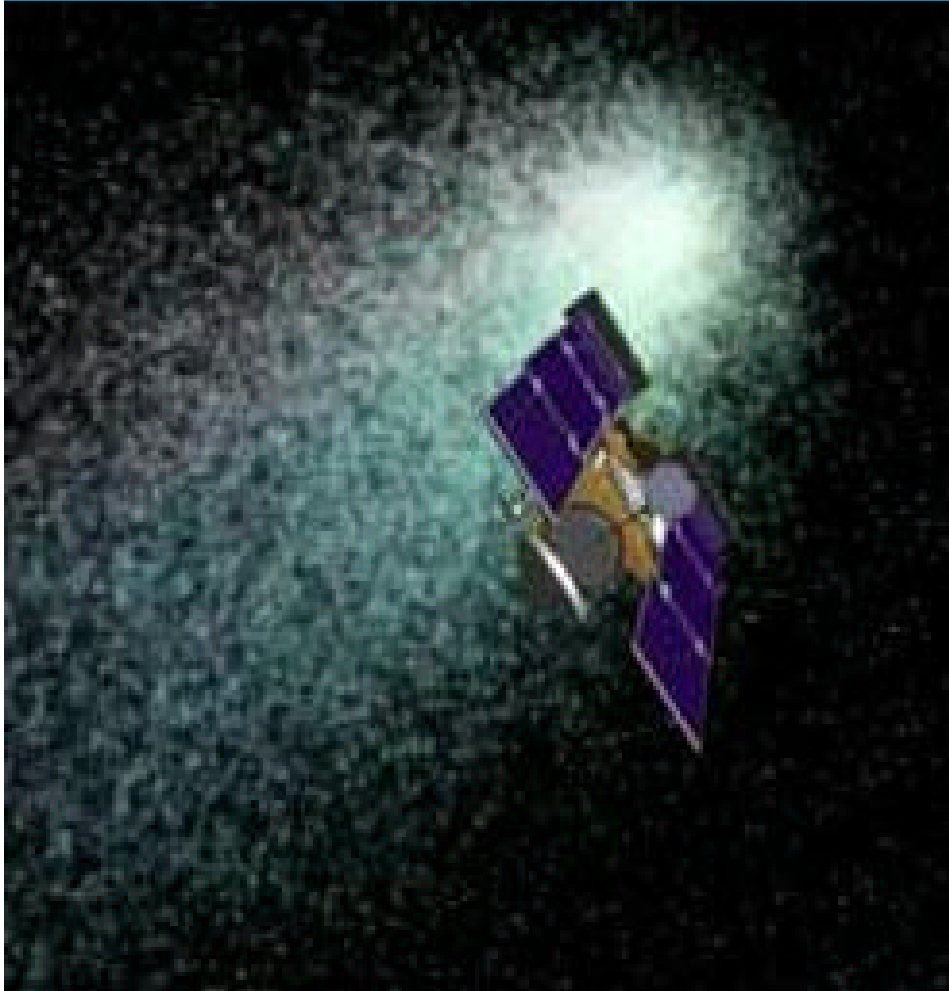
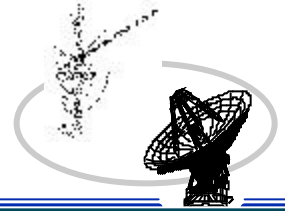


JPL

Comet Nucleus Tour (CONTOUR)



DSN

Loading Study

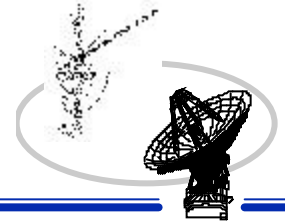
William Hincy

March 23, 2001

NASA Jet Propulsion Laboratory



CONTOUR DSN Support Assessment



Introduction

The Resource Allocation Planning and Scheduling Office (RAPSO) has reviewed the CONTOUR requested Deep Space Network (DSN) requirements. These requirements are from the CONTOUR Project Level Service Agreement (PSLA), Detailed Mission Requirements (DMR) and the RAPSO User Loading Profile (ULP). RAPSO has performed an analysis to determine the expected supportable time for CONTOUR from 2002 through 2008 and identified the periods of contention with other users of the DSN.

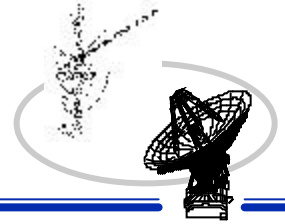
Loading Study Criteria

This study was conducted based upon CONTOUR's ULP, which was signed on November 6, 2000, requesting 70 meter, 34 meter Beam Wave Guide (BWG), and 34 meter High Efficiency (HEF) support in 2002 through 2008. Reference Figure 9.

Per the DMR, CONTOUR is requesting the 34-m BWG only during launch. However, DSS-24, 34 and 54 are expected to have 20Kw uplink capability by April 6, 2003. Thus, CONTOUR should be able to use the 34 meter BWG and 34 meter HEF subnet. It is important to note that there is high oversubscription from November 2003 through February 2004 that will be initially addressed at the August 2001 RARB. In addition, there are a number of Mars missions that are not currently in the FASTER database.



CONTOUR DSN Support Assessment



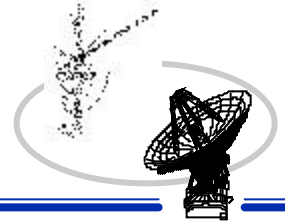
Summary of Study Results

Preliminary DSN loading study results from 2002 through 2008 show the following:

- 1) In general, CONTOUR should receive greater than 90% of their support in 2002. The total support requested from July through October 2002 is 816 hours including pre-and post-calibration times.
- 2) In 2003, CONTOUR should receive greater than 81% of their support. The total support requested from July through December 2003 is 1,186 hours including pre-and post-calibration times.
- 3) In 2004, CONTOUR should receive greater than 95% of their support. The total support requested from July through September 2004 is 403 hours including pre-and post-calibration times.
- 4) In 2005, CONTOUR should receive greater than 95% of their support. The total support requested from January through February 2005 is 385 hours including pre-and post-calibration times.



CONTOUR DSN Support Assessment



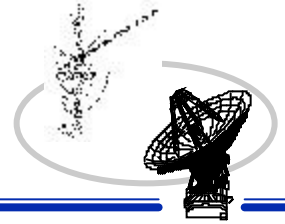
Summary of Study Results Continue

- 6) In 2006, CONTOUR should receive greater than 77% of their support. The total support requested from January through July 2006 is 1,376 hours including pre-and post-calibration times.
- 7) In 2007, CONTOUR should receive greater than 90% of their support. The total support requested from January through March 2007 is 720 hours including pre-and post-calibration times.
- 8) Likewise in 2008, CONTOUR should receive greater than 95% of their support. The total support requested from January through September 2008 is 1,632 hours including pre-and post-calibration times.

The total support requested from 2002 through 2008 is 6,219 hours.



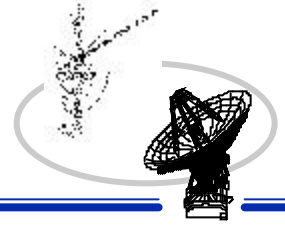
CONTOUR Parameters



- **Mission Objectives:**
 - CONTOUR's goals are to dramatically improve our knowledge of key characteristics of comet nuclei and to assess their diversity precision comparable
- **Projected Launch:** July 01, 2002
- **Trajectory:** High-Earth orbit and interplanetary trajectory
- **Mission Duration:** Prime - 4 years Extended - 2 Years
- **Projected Program Duration:** July 2002 - July 2006



CONTOUR Mission

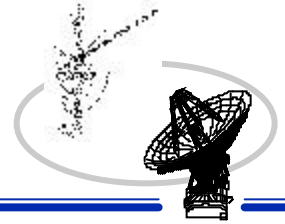


- **Baseline Mission**

- CONTOUR is planned to perform close flybys (approximately 100km) of Encke and Schwassmann-Wachmann-3 comets. A third comet, d'Arrest, may be considered for an extended mission. In addition, CONTOUR will perform detailed compositional data on both gas and dust in the near-nucleus environment.



DSN Mission Support

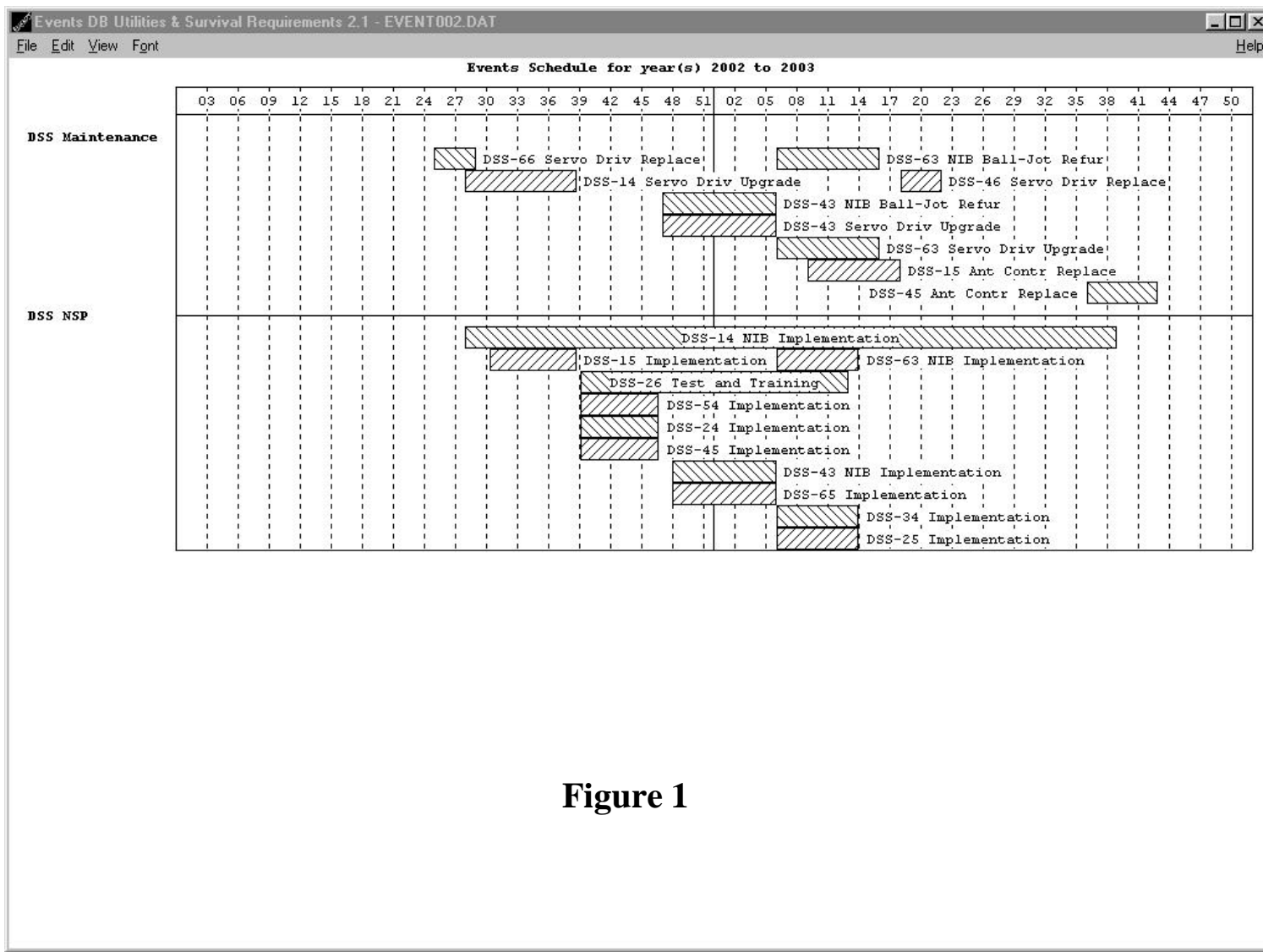
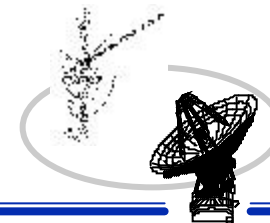


- **Project Tracking Requirements**

- DSN requested to provide standard X-band uplink and downlink services from 34 meter BWG, 34 meter HEF, and 70 meter Subnets
- Current trajectory ephemeris file date: January 25, 2001
- Viewperiods from June 26, 2002 through September 13, 2008

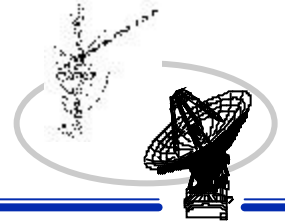
- **DSN Loading Study Support Documents**

- PSLA for fiscal years 2001 - 2006 (September 15, 2000)
- DMR - November 6, 2000



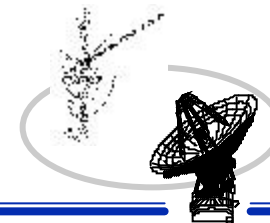


DSN Downtime Analysis



General Analysis

Figure 1 displays the major downtimes in 2002 and 2003. The top horizontal bar identifies the 2002 and 2003 weeks and the left vertical fields identify the DSN downtime headings such as DSS Maintenance and DSS Network Simplification Plan (NSP). The DSS Maintenance events were approved prior to the February 2001 RARB and the DSS NSP events were approved at the February 2001 RARB.



CONTOUR Launch, Early Orbit and Injection Forecasted 2002 Weekly Support

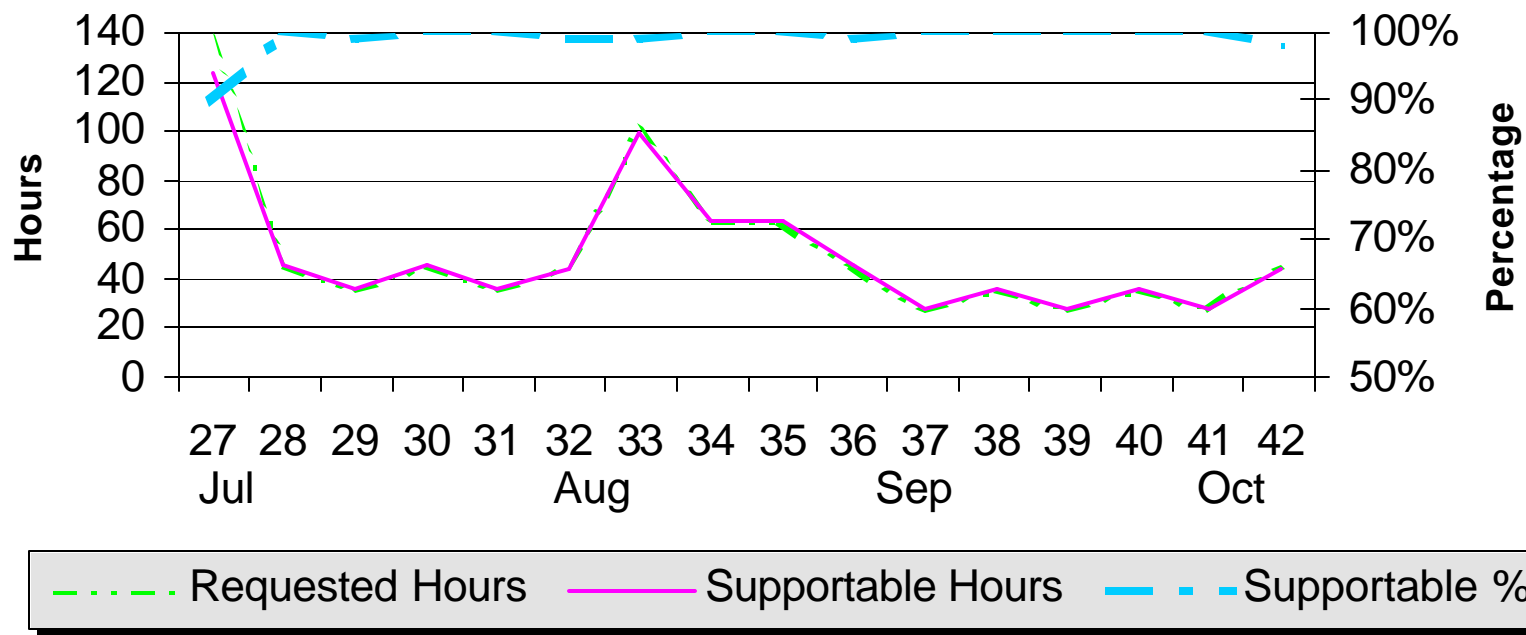
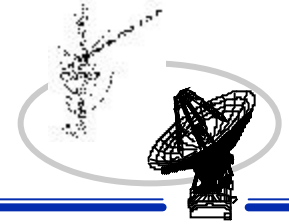


Figure 2



2002 DSN Support Analysis

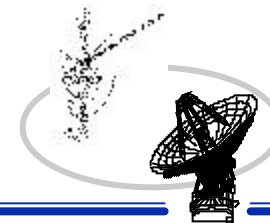


General DSN Support

CONTOUR should receive greater than 90% of their requested support in 2002. Figure 2 shows CONTOUR's requested hours (green dash line), forecasted supportable hours (solid purple line) and supportable percentage (dashed blue line).

Launch, Early Orbit and Injection

During week 27, CONTOUR is requesting fifteen 8-hour passes on the 34 meter HEF subnet. This request is to support a CONTOUR launch on July 1, 2002. CONTOUR is forecasted to receive 90% of their requested support during this week. However, the February 2001 RARB review presented Contention Period #6. This Contention Period, which included weeks 23 through 27, recommended CONTOUR receiving their requested support on the 34 meter HEF subnet.



CONTOUR Earth Gravity Assist and Encke Encounter Forecasted 2003 Weekly Support

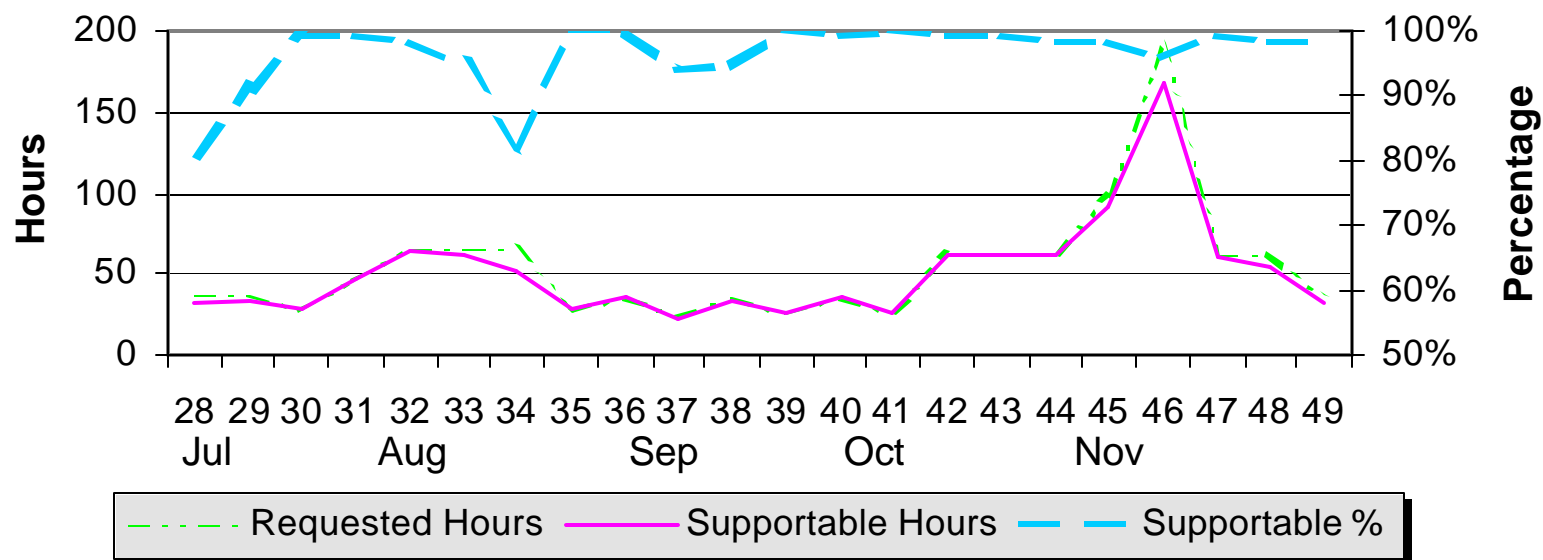
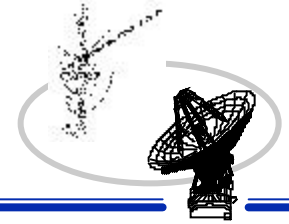


Figure 3



2003 DSN Support Analysis



General DSN Support

CONTOUR should receive greater than 81% of their requested support in 2003. Figure 3 shows CONTOUR's requested hours (green dash line), forecasted supportable hours (solid purple line) and supportable percentage (dashed blue line).

Routine Support

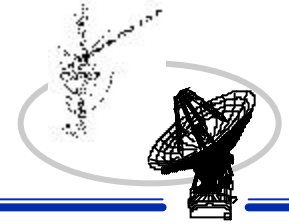
During week 28, CONTOUR is requesting three 8-hour passes on the 34 meter HEF subnet and one 8-hour pass on the 70 meter subnet. CONTOUR is forecasted to receive 81% of their requested support during this week. However, the February 2001 RARB review presented Contention Period #20. This Contention Period, which included weeks 26 through 29, should allow CONTOUR to receive their requested support on the 34 meter HEF subnet.

Earth Swingby Maneuver

During week 34, CONTOUR is requesting seven 8-hour passes on the 34 meter HEF subnet. CONTOUR is forecasted to receive 82% of their requested support during this week. However, the February 2001 RARB review presented Contention Period #22. This Contention Period, which included week 33, recommended CONTOUR receiving their requested support on the 34 meter HEF subnet.



2003 DSN Support Analysis

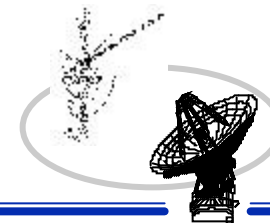


Encke Encounter

During week 46, CONTOUR is requesting twenty 8-hour passes on the 34 meter HEF subnet. This request is to support the Encke comet flyby on November 13, 2003. CONTOUR is forecasted to receive 96% of their requested support during this week.

Impact to Other Projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 46 are: Cassini (CAS), DSS Maintenance, Mars Express Orbiter (MEX), Mars Exploration Rover A (MERA), Stardust (SDU) and Voyager 2 (VGR2). CAS is performing routine operations and requesting one 9-hour pass on DSS-45. DSS Maintenance is performing routine maintenance. MEX is in Mars capture phase and requesting one 7-hour pass on DSS-65. MERA is in mini-cruise and requesting seven 8-hour passes. SDU is performing a TCM and conducting its encounter at P/Wild 2 and requesting four 4 to 8-hour passes. Negotiation with these projects to secure additional support is required.



CONTOUR Earth Gravity Assist Forecasted 2004 Weekly Support

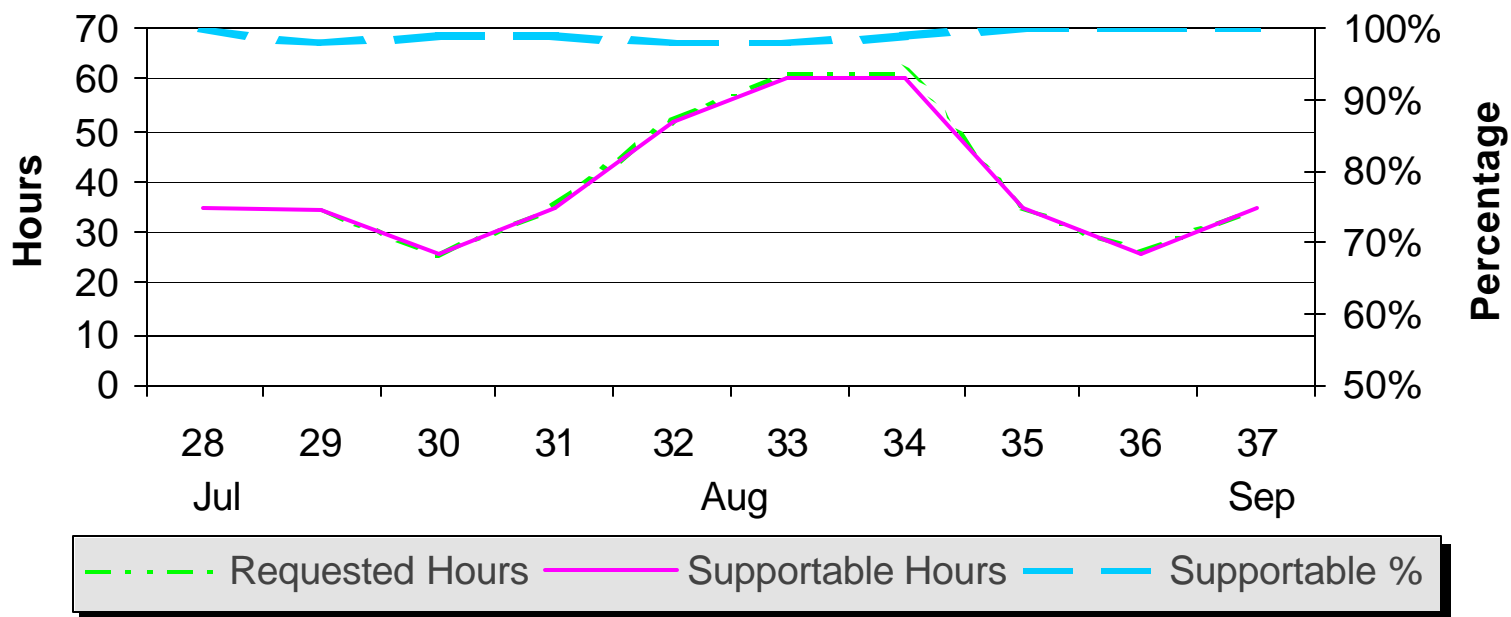
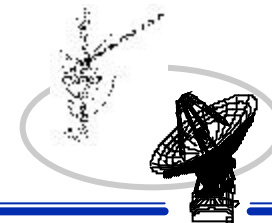


Figure 4



2004 DSN Support Analysis



General DSN Support Earth

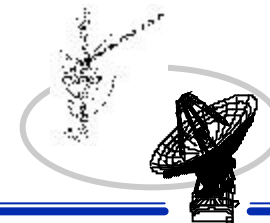
CONTOUR should receive greater than 95% of their requested support in 2004. Figure 4 shows CONTOUR's requested hours (green dash line), forecasted supportable hours (solid purple line) and supportable percentage (dashed blue line).

Earth Swingby Maneuver

During week 33, CONTOUR is requesting seven 8-hour passes on the 34 meter HEF subnet. This request is to support an Earth Swingby Maneuver on August 13, 2004. CONTOUR is forecasted to receive 98% of their requested support during this week. During this week, CONTOUR is only visible from the Goldstone and Canberra Complexes.

Impact to Other Projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 33 are: Cassini, DSS Maintenance, Stardust and Voyager 1 (VGR1) and Voyager 2. CAS is conducting its tour phase and requesting three to four 9-hour passes at DSS-65. DSS Maintenance is performing routine maintenance. SDU is performing routine operations and requesting one 6-hour pass. VGR1 is conducting routine operations and requesting seven 8-hour passes on DSS-65. VGR2 is conducting routine operations and requesting three to four 16-hour passes on DSS-45. Negotiation with these projects to secure additional support is required.



CONTOUR Earth Gravity Assist Forecasted 2005 Weekly Support

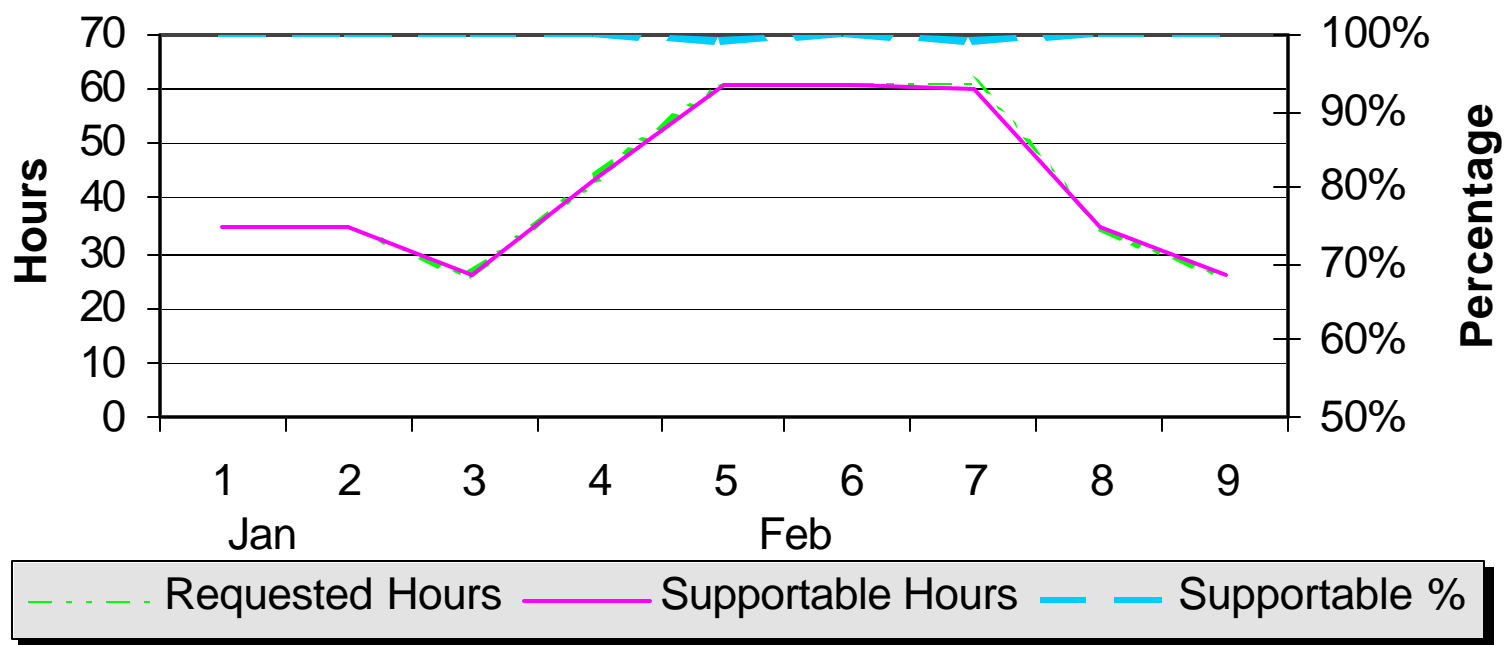
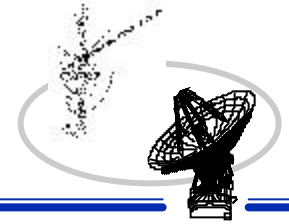


Figure 5



2005 DSN Support Analysis



General DSN Support

CONTOUR should receive greater than 95% of their requested support in 2005. Figure 5 shows CONTOUR's requested hours (green dash line), forecasted supportable hours (solid purple line) and supportable percentage (dashed blue line).

Earth Swingby Maneuver

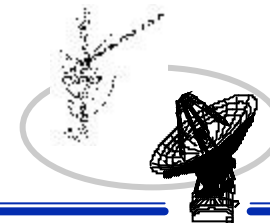
During week 06, CONTOUR is requesting seven 8-hour passes on the 34 meter HEF subnet. This request is to support an Earth Swingby Maneuver on February 09, 2005. CONTOUR is forecasted to receive 100% of their requested support during this week. During this week, CONTOUR is only visible from the Goldstone and Madrid Complexes.

Impact to Other Projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 06 are: DSS Maintenance and Stardust. DSS Maintenance is performing routine maintenance. SDU is performing routine operations and requesting one 6-hour pass.



2006 DSN Support Profile



CONTOUR Earth Gravity Assist and SW3 Encounter
Forecasted 2006 Weekly Support

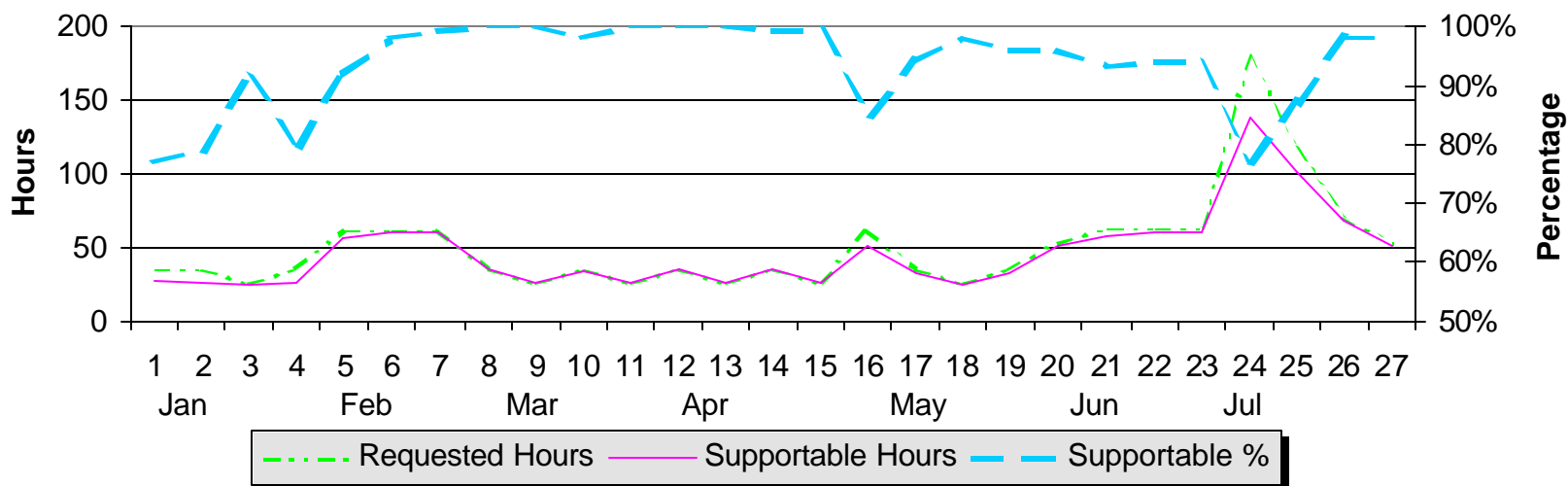
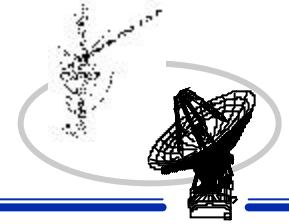


Figure 6



2006 DSN Support Analysis



General DSN Support

CONTOUR should receive greater than 77% of their requested support in 2006. Figure 6 shows CONTOUR's requested hours (green dash line), forecasted supportable hours (solid purple line) and supportable percentage (dashed blue line).

Routine Support

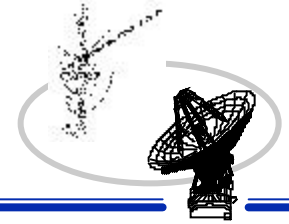
During week 01, CONTOUR is requesting three 8-hour passes on the 34 meter HEF subnet. CONTOUR is forecasted to receive 77% of their requested support during this week. During this week, CONTOUR is only visible from the Goldstone and Madrid Complexes.

Impact to Other Projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 01 are: DSS Maintenance, Europa Orbiter (EURO), Mars Reconnaissance Orbiter (MRO), Messenger (MSGR), Stardust and Voyager 1. EURO is in launch phase and requesting eighteen 8-hour passes. MRO is in approach phase and requesting twenty-one 8-hour passes. MSGR is performing routine operations and requesting one 4-hour pass. SDU is performing a TCM and conducting entry operations and requesting four to five 8-hour passes on DSS-65. VGR1 is performing routine operations and requesting seven 8-hour passes on DSS-65. Negotiation with these projects to secure additional support is required.



2006 DSN Support Analysis



Earth Swingby Maneuver

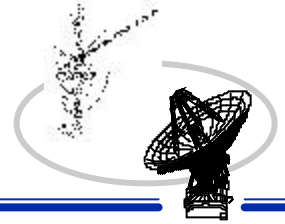
During week 06, CONTOUR is requesting seven 8-hour passes on the 34 meter HEF subnet. This request is to support an Earth Swingby Maneuver on February 09, 2006. CONTOUR is forecasted to receive 98% of their requested support during this week. During this week, CONTOUR is only visible from the Goldstone and Madrid Complexes.

Impact to Other Projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 06 are: DSS Maintenance, Europa Orbiter, Mars Reconnaissance Orbiter, Messenger, Stardust and Voyager 1. DSS Maintenance is performing routine maintenance. EURO is conducting beacon and routine operations and requesting six .1-hour passes and one 4-hour pass . MRO is conducting a TCM and in Mars approach phase and requesting ten to eleven 8-hour passes. VGR1 is performing routine operations and requesting seven 8-hour passes on DSS-65. Negotiation with these projects to secure additional support is required.



2006 DSN Support Analysis



Routine Support

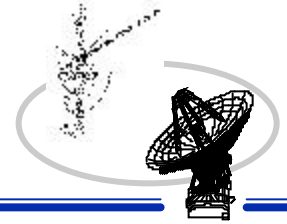
During week 16, CONTOUR is requesting seven 8-hour passes on the 34 meter HEF subnet. CONTOUR is forecasted to receive 85% of their requested support during this week. During this week CONTOUR is only viewable from the Canberra Complex.

Impact to Other Projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 16 are: DSS Maintenance, Europa Orbiter, Mars Reconnaissance Orbiter and Voyager 2. DSS Maintenance is performing routine maintenance. EURO is conducting beacon and routine operations and requesting six .1-hour passes and one 4-hour pass . MRO is conducting Mars aerobraking and requesting twenty-one 8-hour passes. Voyager 2 is in routine operations and requesting three to four 16-hour passes on DSS-45. Negotiation with these projects to secure additional support is required.



2006 DSN Support Analysis

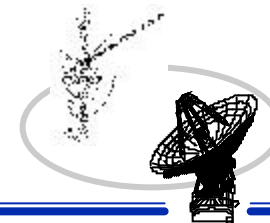


SW3 Encounter

During week 24, CONTOUR is requesting nineteen 8-hour passes on the 34 meter HEF subnet. This request is to support the SW3 comet flyby on June 18, 2006. CONTOUR is forecasted to receive 77% of their requested support during this week.

Impact to Other Projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 24 are: DSS Maintenance, Europa Orbiter and Mars Reconnaissance Orbiter. DSS Maintenance is performing routine maintenance. EURO is conducting beacon operations and requesting six .1-hour passes . MRO is conducting Mars aerobraking and requesting twenty-one 8-hour passes. Negotiation with these projects to secure additional support is required.



CONTOUR Earth Gravity Assist Forecasted 2007 Weekly Support

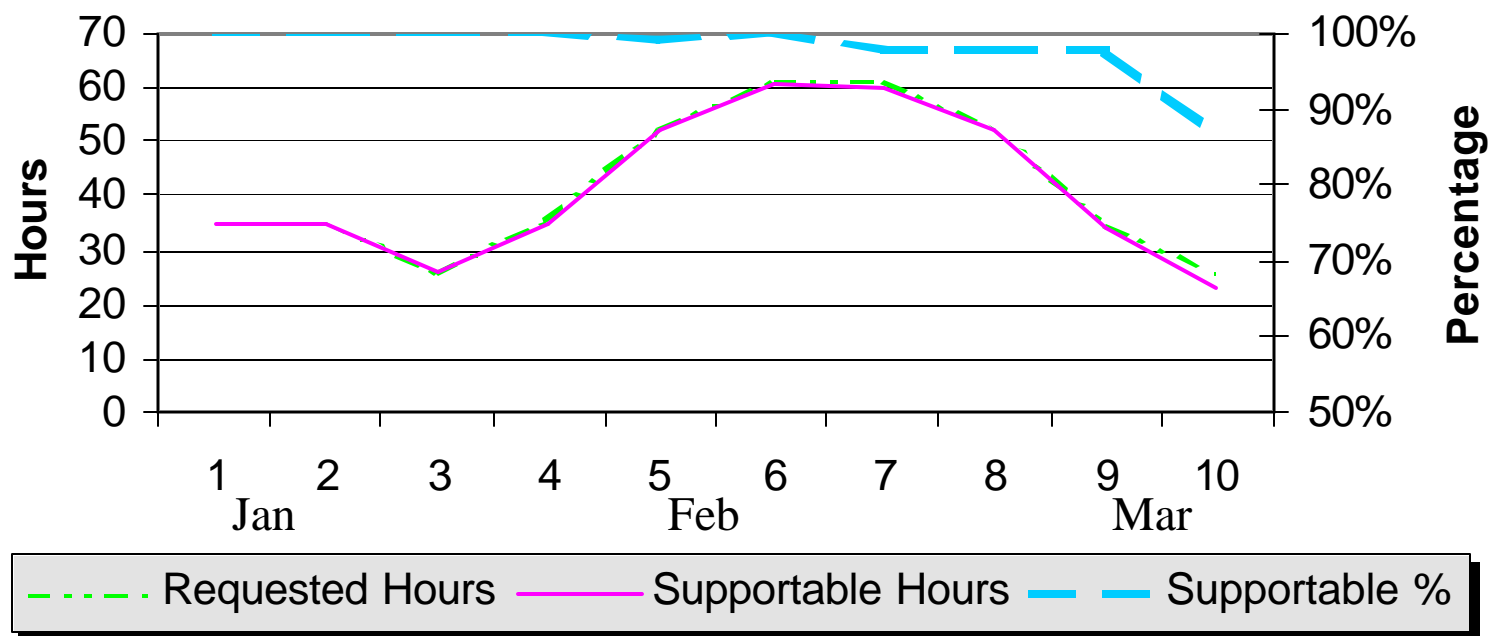
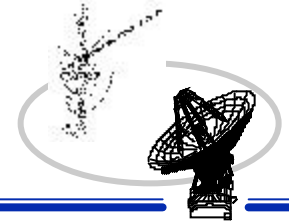


Figure 7



2007 DSN Support Analysis



General DSN Support

CONTOUR should receive greater than 90% of their requested support in 2007. Figure 7 shows CONTOUR's requested hours (green dash line), forecasted supportable hours (solid purple line) and supportable percentage (dashed blue line).

Earth Swingby Maneuver

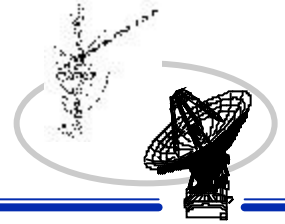
During week 06, CONTOUR is requesting seven 8-hour passes on the 34 meter HEF subnet. This request is to support an Earth Swingby Maneuver on February 09, 2007. CONTOUR is forecasted to receive 100% of their requested support during this week. During this week, CONTOUR is only visible from the Goldstone and Madrid Complexes.

Impact to Other Projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 06 are: DSS Maintenance, Europa Orbiter and Mars Reconnaissance Orbiter and Space Infrared Telescope Facility (SRTF). DSS Maintenance is performing routine maintenance. EURO is conducting beacon and routine operations and requesting six .1-hour passes and one 4-hour pass. MRO is mapping and requesting four to five 8-hour passes. SRTF is performing routine operations and requesting one to two 1-hour passes. Negotiation with these projects to secure additional support is required.



2007 DSN Support Analysis



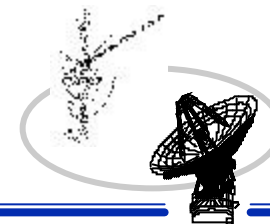
Routine Support

During week 10, CONTOUR is requesting three 8-hour passes on the 34 meter HEF subnet. CONTOUR is forecasted to receive 87% of their requested support during this week.

Impact to Other Projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 10 are: DSS Maintenance, Europa Orbiter, Mars Reconnaissance Orbiter and Space Infrared Telescope Facility. DSS Maintenance is performing routine maintenance. EURO is conducting beacon and routine operations and requesting six 1-hour passes and one 4-hour pass. MRO is mapping and requesting four to five 8-hour passes. SRTF is performing routine operations and requesting one to two 1-hour passes. Negotiation with these projects to secure additional support is required.

2008 DSN Support Profile



CONTOUR d'Arrest and Earth Gravity Assist
Forecasted 2008 Weekly Support

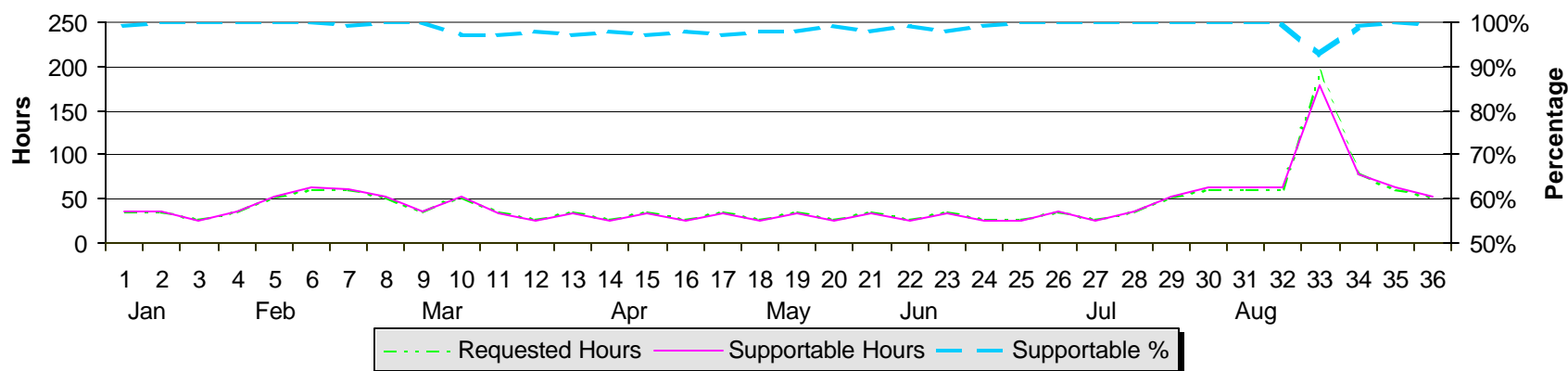
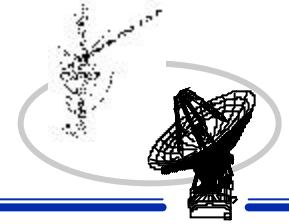


Figure 8



2008 DSN Support Analysis



General DSN Support

CONTOUR should receive greater than 95% of their requested support in 2008. Figure 8 shows CONTOUR's requested hours (green dash line), forecasted supportable hours (solid purple line) and supportable percentage (dashed blue line).

Earth Swingby Maneuver

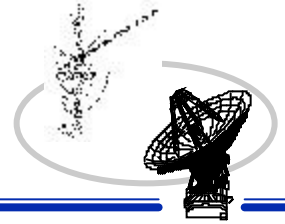
During week 06, CONTOUR is requesting seven 8-hour passes on the 34 meter HEF subnet. This request is to support an Earth Swingby Maneuver on February 10, 2008. CONTOUR is forecasted to receive 100% of their requested support during this week.

Impact to Other Projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 06 are: DSS Maintenance, Europa Orbiter, Mars 07 Lander (M07L), Voyage 1 and Voyager 2. DSS Maintenance is performing routine maintenance. EURO is conducting beacon operations and requesting six .1-hour passes. M07L is performing routine operations and requesting seven 8-hour passes. VGR 1 is performing routine operations and requesting seven 8-hour passes on DSS-65. VGR2 is performing routine operations and requesting three to four 16-hour passes on DSS-45. Negotiation with these projects to secure additional support is required.



2008 DSN Support Analysis

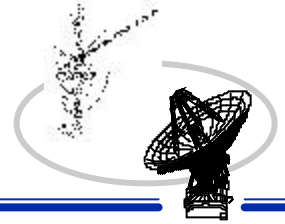


D'Arrest Encounter

During week 33, CONTOUR is requesting twenty-one 8-hour passes on the 34 meter HEF subnet. This request is to support the d'Arrest comet flyby on August 16, 2000. CONTOUR is forecasted to receive 93% of their requested support during this week.

Impact to Other projects

Other projects who are using the 34 meter HEF subnet and are in CONTOUR's viewperiod during week 33 are: DSS Maintenance, Europa Orbiter, Mars 07 Lander, Messenger and Rosetta (ROSE). DSS Maintenance is performing routine maintenance. EURO is conducting beacon operations and requesting seven .1-hour passes. M07L is performing routine operations and MARS approach and requesting thirteen 8-hour passes. MSGR is performing routine operations and requesting one 4-hour pass. ROSE is conducting a flyby and requesting one 4-hour pass. Negotiation with these projects to secure additional support is required.



◆ Comment:

- As always, the results of this analysis are preliminary in that the network load changes as requirements for planned missions are input and updated. We will continue to work with the CONTOUR project and other users of the DSN to maximize the time available for each user.

◆ Questions:

- Why does the CONTOUR spacecraft need 70M support?
- Does CONTOUR Have Any Preferred Subnet or Antenna Set?
- Does CONTOUR Have An Updated PSLA?
- Does CONTOUR Anticipate Any Changes In Requirements?